Institutions and Economic Success

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Abstract

According to recent literature on growth and development differences in levels of economic success across countries are driven primarily by institutions that frame the economic environment in which people produce and interact. This paper suggests a method to measure institutions. We use a form of cluster analysis to discover relationships between elements of institutions (individual indicators), resulting in new (latent) variables which we try to interpret as "real" institutions. The method is applied to a dataset consisting of more than 100 institutional indicators for 20 OECD countries, which are potentially important to explain differences across these countries. We reduce this information to a restricted number of clusters. These institutions are used to classify countries. Thereafter, we relate our institutions to two measures of economic success: productivity and structural unemployment. Overall, despite the crudity of the indicators at our disposal, we do appear to be able to associate a great part of the cross-country variance in economic success with institutional differences between countries.

Key words: Cluster analysis, Institutions, Productivity, Unemployment.

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1 **Introduction**

It has been widely observed that changes in transport and communication technologies have enhanced the ease with which people and goods cross national borders. Production is now set up on a modular basis, whereby production of the modules is often spread out across the globe, depending on the comparative advantages of the regions. As a result many corporations now function within a global network, which has resulted in new forms of internationalization, the so-called intra-firm trade. New technologies such as flexible manufacuturing (a combination of just-in-time production and information technology) in many ways facilitated this process. In some sectors, trends towards product differentiation provided opportunities for small, flexible and innovative companies, making market structures even more competitive. Internationalization implies a reduction in the effectiveness of traditional monetary and budgetary policies, as a result of 'leakage' effects in a globalized world economy. But the power of national states may regain some of their lost capacity to act by refocusing economic policies on the elements of *institutions*, especially those factors which are largely *immobile* between countries.

Many policies promoted by the IMF and the World Bank, such as deregulation, privatization, and stable business environments, are implicitly based on the assumption that these policies will create incentives for entrepreneurs to develop new businesses, adopt new technologies, and the like. Those investments by entrepreneurs create a type of capital, that can be called *business capital* (*cf.* Schmitz, 1993). A significant aspect of business capital is that it is often specific to a region. For example, to introduce a new product in an area, an entrepreneur must make adjustments to suit local tastes; to introduce a new technology, the entrepreneur must make the process suitable to local skills. What matters is the interactions between institutions and strategic behaviour. To understand differences in levels of economic success across countries we have to understand differences in institutions that frame the economic environment in which people produce and interact. The project of this paper extends previous empirical work on growth and development by trying to identify the constituent factors of institutions.

The contribution of this paper is empirical. Current empirical research on long-run economic performance is mainly restricted to single equation tests of macroeconomic growth models based on large cross-country samples. However, these studies all face substantial problems in estimating and interpreting growth regressions (cf. Temple, 1999). Moreover, growth regressions fail to explore the opportunity of multidisciplinary research. As already noted by Knack and Keefer (1995), institutional indicators are conspicuously absent in empirical research on growth and productivity. Hence, according to Temple (1999), one promising approach to breathe new life into growth empirics: "...is to model social and political influences on growth as latent variables related to a variety of observable indicators." This is the mode of research we have chosen here.

The plan of the paper is as follows. Starting point is the analysis of Nickell and Layard (1997) for 20 OECD countries relating unemployment and productivity on a set of labour market indicators. One reason for focussing on this restricted number of countries is that we want to build our analysis on a recent and well-known study, relating individual indicators of institutions to productivity and unemployment. Another reason is that the OECD countries are likely to fall on a common surface, so

that some econometric problems in growth empirics (cf. Fagerberg (1994), Mankiw (1995) and Temple (1999)) might be avoided. We extend the dataset of Nickell and Layard by a large number of institutional indicators. Subsequently, we use a form of cluster analysis to discover relationships between individual indicators. The clusters are used to classify countries. We conclude by relating our institutions to cross-country differences in productivity and structural unemployment.

2 **Data**

2.1 **Product Market Indicators**

In this paper over 100 indicators are reduced to less than 20 clusters. The set of indicators is described in the Data Appendix. The greater part of the data used in this paper comes from the *World Competitiveness Yearbook* (WCY). The WCY measures how national environments sustain the domestic and global competitiveness of the firms that operate in the countries covered. The WCY uses two types of data: hard data and soft data. Hard data are statistical indicators obtained from international and regional organisations, private institutions and national institutes. Soft data are compiled by the *Executive Opinion Survey*. The WCY asks a number of top and middle managers to evaluate the present and future competitiveness for the country in which they operate. There are, of course, limitations to survey data. The questions asked are more vague than what ideally an economist would like to use. However, our focus is on long-run determinants that are likely to change slowly over time. That is why we do not draw upon the time series dimension of the WCY panel. Instead we use a large number of individual indicators to ensure that the resulting clusters are robust with respect to subjective elements. We also have chosen to focus on the results of the surveys in the first half of the 1990s. In this period the advanced countries returned to the long-run pattern of investment and growth, which started around 1870 (*cf.* Van de Klundert and Van Schaik, 1996). Deviations were the period including World War II and the process of catching up vis à vis the US economy in the 1950s and in the 1960s. High inflation and high turbulence in the 1970s and 1980s was the price for this exceptional golden era of economic growth in Western Europe. Presumably, the results of surveys in the 1990s are more representative for stable long-run expectations about the fundamentals of the economy than the results of surveys in the 1980s. The relatively steady development of most OECD economies in the second half of the 1990s supports this line of thought.

2.2 **Labour Market Indicators**

Labour market indicators are borrowed from Nickell and Layard (1997). In a series of papers, Nickell and Layard (1997) and Nickell (1997, 1998) have investigated the relationship between unemployment and labour market institutions across 20 OECD countries: Austria, Belgium, Denmark, Finland, France, West Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the UK, Canada, the US, Japan, Australia and New Zealand.

Nickell and Layard present regressions based on two cross-sections dated 1983-88 and 1989-94. The dependent variables are the unemployment rates (total, long-term and short-term). The set of independent variables is a collection of labour market indicators. Direct indicators of labour market rigidity are employment protection, an index measuring the extent of employment protection and labour standards, an index measuring the strength of legislation governing several aspects of the labour market, including working time, fixed-term contracts, employment protection, minimum wages and employees' representation rights. Three indicators summarize the official treatment of the unemployed: benefit duration, active labour market policies and the benefit replacement ratio. The process of wage bargaining is characterised by five indicators: union co-ordination, employer co-ordination, the union coverage index, union density and the decentralisation ranking of wage bargaining. Decentralisation refers to the level at which bargaining occurs: plant, firm, industry, economy. In addition, Nickell and Layard distinguish payroll taxes from the total tax wedge. The latter gives a crude measure of the wedge between real labour costs and real take-home pay. Another indicator is the proportion of households living in owner-occupied accomodation, which represents a possible proxy for the barriers to regional mobility, as suggested by Oswald (1996). Nickell and Layard also present a measure of the real interest rate, which may be related to the extent of pressure on prices and also to wage pressure insofar as non-labour income is increasing in the real interest rate. Finally, Nickell and Layard introduce the average change in inflation to capture long-term variations across countries in the stance of macroeconomic policy.

The regression results of Nickell and Layard show that labour market indicators that conventionally come under the heading of direct rigidities (employment protection and labour standards) have no observable impact on unemployment. There is also no significant effect of the degree of decentralization of wage bargaining on unemployment. Nickell and Layard (1997) therefore conclude that "..the key labour market institutions on which policy should be focussed are unions and social security systems. Encouraging product market competition is a key policy to eliminate the negative effect of unions. Minimising the adverse incentive effects is the important issue for social security. By comparison, spending time worrying about strict labour market regulations, employment protection and minimum wages is probably time simply wasted". Interestingly, the conclusion that "Encouraging product market competition is a key policy to eliminate the negative effect of unions" does not stem from their empirical investigations (Nickell and Layard did not introduce a variable measuring product market competition). This suggestion, however, is in line with the theoretical model as developed in Nickell (1998). The model predicts that the rate of unemployment and the autonomous factors affecting wages and prices are related over the long term.

Nickell and Layard (1997) also present some regressions relating growth rates of labour productivity to labour market indicators. It appears that many indicators are insignificant. The only clear-cut results are the positive impact of employment protection and the negative effect of the total tax wedge. But both of these are completely wiped out once convergence is controlled for, using the initial productivity gap between the country concerned and the United States. So their main finding is that labour market institutions appear to have a weak association with productivity growth.

2.3 **Other Indicators**

The core of the dataset consists of indicators from the *World Competitiveness Yearbook*, and labour market indicators from Nickell and Layard. This set is supplemented by detailed data on active labour market policies from Martin (1998), data on the share of labour force aged 45 and over, and total R&D scientists and engineers of university graduates per 100 of labour force from the OECD Jobs Study (1994), productivity measures in service industries from Pilat (1996), educational indicators from Lee and Barro (1997), and indicators concerning business risks from Knack and Keefer (1995).

3 **Clustering**

3.1 **Analysis**

Institutions are very difficult to measure, but there are a large number of indicators available, which measure institutions in an indirect way. In this paper we use a form of cluster analysis to discover relationships between individual indicators, resulting in new (latent) variables which we try to interpret as "real" institutions. We use the term cluster analysis for a procedure, based on the concept of principal components, that creates new variables, which we call clusters (cf. Jackson, 1991). In the procedure we follow there is a trade-off between two objectives: independence and interpretation. The clusters should be independent from each other, so that they can be used as independent variables in regression analysis. In addition, the clusters should be created in such a way that every original indicator can be assigned to exactly one cluster. By construction, principal components are independent, but every principal component is created as a linear combination of every original indicator, violating the second objective of easy interpretation. We apply Oblique Principal Component Cluster Analysis (OPCCA). This procedure first computes principal components and then transforms these principal components to obtain new variables (clusters), which are easier to interpret, because every original indicator gets a nonzero weight in just one cluster (cf. Jolliffe, 1986). This method therefore lays more emphasis on the second objective stated above. Furthermore, applying this method typically yields fewer clusters than there are indicators, thereby reducing the number of variables (institutions).

Applying the OPCCA clustering method on our set of 101 indicators yields a total of 19 clusters. In section 3.2, of each cluster, we list the constituent indicators (detailed descriptions can be found in the Data Appendix), the signs of the associated factor loadings and the $(1-R^2)$ ratios. The $(1-R^2)$ ratio of an indicator is defined as one minus the squared ratio of the correlation between that indicator and its own cluster and the maximum correlation between that indicator and any other cluster. If an indicator is closely correlated with more than one cluster, this ratio is close to 1, and if it is typical of only one cluster, this ratio is close to 0. An example is the indicator WORKERMO ("Employees truly identify with company objectives") in cluster 12. The R-squared of this indicator with cluster 12

is high (0.91) and the R-squared with the next closest cluster is low (0.51). So the ($1-R^2$) ratio is very low: 0.19 (=0.09/0.49).

Furthermore, we report the Proportion of Variation Explained by each cluster and the Second Eigenvalue. The Proportion Explained by a cluster is the variance of the newly created cluster variable divided by the sum of the variances of its constituent indicator variables. A cluster having a high Second Eigenvalue suggests that there might be two different structures within that cluster. Our procedure splits a cluster when the Second Eigenvalue is larger than 1. In section 3.3 we will elaborate on this criterion.

3.2 **Results**

In naming these clusters, one should of course try to take as many constituent indicators into account as possible. For most of the clusters this is possible, but some of them are not so easy to interpret. Where interpretation of a cluster is less straightforward (which we indicate with an asterisk), we base our name mainly on the indicators with the lowest ($1-R^2$) ratio, *i.e*, the indicators that are most typical for that cluster.

C1: *Social Infrastructure* (Explained 71%, Second Eigenvalue 0.62)

INTERDIS (+) 0.88, INTERLPRO (+) 0.67, NATIRISK (+) 0.55, STRATALL (+) 0.77, BURDELAY (+) 0.44, COMTRANS (+) 0.49, COSTOCAP (+) 0.50, CONTENFO (+) 0.50, INFLA (+) 0.69

The first cluster can easily be interpreted as *Social Infrastructure*. The main indicators in this cluster are the four variables we have obtained from the BERI dataset, which have all grouped together in this cluster. Switzerland, Germany, the USA, the Netherlands and Japan rank at the top of this cluster, whereas the Latin European countries, Australia and France rank at the bottom.

C2: *Employer Orientation** (Explained 61%, Second Eigenvalue 0.88)

RRATE (+) 0.63, CAPITALT (-) 0.77, EMCORD (+) 0.45, PLIABILI (+) 0.74, FORLANGS (+) 0.21, EDSYSTEM (+) 0.70

We interpret cluster 2 as *Employer Orientation*. An important indicator in this cluster is the degree of employer coordination in wage bargaining, which is positively correlated with the benefit replacement ratio and the extent foreign languages are taught at compulsory schools. This cluster tells us something about the role employers play in society as a whole in relation to the educational system and the welfare system. *Employer Orientation* is high in the Scandinavian countries and Austria and low in the US, the UK, Italy, Australia and Spain.

C3: *Business Practices* (Explained 77%, Second Eigenvalue 0.60)

BURCRACY (+) 0.44, IMPROPER (+) 0.42, TELECOMM (+) 0.36, DELEGATE (+) 0.45, COMPUTER (+) 0.72, POSTINGS (+) 0.65, NEWINFOT (+) 0.45, COBOARDS (+) 0.52

The third cluster relates to the environment in which businesses can oparate as well as the practices within these businesses. Information and communication technology plays an important role in *Business Practices*. New Zealand and the Scandinavian countries rank high, while the Latin European countries, Japan and France rank low.

C4: *Long-Term Emphasis* (Explained 60%, Second Eigenvalue 0.97)

PROTECTI (-) 0.80, TOTALRES (+) 0.77, SCHDAY (+) 0.67, ECOFLEXI (+) 0.31, LONGOBJE (+) 0.52, MARKETIN (+) 0.62, NATCULTR (-) 0.54, OVER45 (+) 0.49

Most of the indicators in this cluster contain information about the *Long-Term Emphasis* of the economy. Negative signs of PROTECTI ("National protectionism does not prevent foreign products and services from being imported") and NATCULTR ("National culture is open towards foreign cultures") imply that the long-term emphasis of a country is negatively correlated with the economic and cultural openness of that country towards other countries. Japan, Switzerland, Germany, Sweden and Austria rank high, whereas Portugal, Ireland, New Zealand, Belgium and Australia rank low.

C5: *Labour Immobility*[*] (Explained 49%, Second eigenvalue 0.87)

HOME (+) 0.50, MARKETDO (-) 0.70, SHPUPS (-) 0.80, INDUSDIS (+) 0.47, DISTRITE (-) 0.76, ARABLEAR (+) 0.69

High home ownership, a large arable area per capita and a low productivity in the transport sector point to a low population density. An important economic aspect of this is *Labour Immobility*. This does however not relate to the other three indicators in this cluster. This cluster explains only 49% of variation, underlining its heterogeneity. *Labour Immobility* is high in Australia, Finland, Spain, Norway and Canada and low in Switzerland, the Netherlands, Germany, Austria and Belgium.

C6: *Labour Market Flexibility* (Explained 76%, Second Eigenvalue 0.48)

UNION (-) 0.54, LSTAND (-) 0.40, EMPRO (-) 0.35, HIRINGFI (+) 0.35, NONWAGES (+) 0.42, FREEMANA (+) 0.46

With a high amount of variation explained and a low second eigenvalue, this cluster represents all its

six constituent indicators very well. *Labour Market Flexibility* is high in the Anglo-Saxon countries and Switzerland and low in the Latin European countries, France and Sweden.

C7: *Entrepreneurship* (Explained 64%, Second Eigenvalue 1.00)

ENTREPRE (+) 0.60, PARALLEL (+) 0.40, RESTRUCT (+) 0.53, MARKETTI (+) 0.57, ENTINNOV (+) 0.42.

Although this cluster seems to be quite coherent, a second eigenvalue of 1.00 indicates that it is right on the edge of being split into two parts: ENTREPRE, ENTINNOV and MARKETTI on the one hand and PARALLEL and RESTRUCT on the other hand[1]. (This splitting can be obtained by simply lowering the maximum second eigenvalue allowed to slightly below 1.00; see section 2.4). The first group is indicative of the emphasis on innovation, while the second represents a more general attitude of businesess towards economic change. *Entrepreurship* is high in New Zealand, the US, Denmark, the Netherlands and Ireland, and low in Portugal, Germany, Spain, Japan and Australia.

C8: *Government Priorities*[*] (Explained 64%, Second Eigenvalue 0.58)

HOURS (+) 0.51, COMPPRIC (+) 0.60, SHPUPP (-) 0.46, GOVECPRT (+) 0.48

This eighth cluster says something about *Government Priorities*: it distinguishes between governments that are more concerned with competititive economic policies and governments that lay more emphasis on redistribution of wealth. Japan, Portugal, the US, Ireland and the UK rank high in this cluster, whereas the Scandinavian countries and Switzerland rank low.

C9: *Physical Infrastructure* (Explained 66%, Second Eigenvalue 0.89)

ROADINFR (+) 0.55, AIRINFRA (+) 0.53, RAILINFR (+) 0.63, PORTACCE (+) 0.79, ACCESSIN (+) 0.59, SOCIALRE (+) 0.68, BASICRES (+) 0.57, LIFEQUAL (+) 0.92, MAINLINS (+) 0.76

Cluster 9 quite clearly represents the *Physical Infrastructure* of a country, including communication infrastructure. In addition, it contains the two social variables SOCIALRE ("Managers pay a lot of attention to their responsibility towards society") and LIFEQUAL ("Quality of life in your country is very adequate"), though the latter has a high ($1\text{-}R^2$) ratio. The Scandinavian countries (Norway excluded), Switzerland and Germany rank high, and the Latin European countries, Ireland and the UK rank low.

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[1] The indicators ENTREPRE and ENTINNOV refer to the same question ("Managers generally have a good sense of entrepreneurship and innovation") from WCY in 1994 and 1996.

C10: *Openness to Immigration*[*] (Explained 63%, Second Eigenvalue 0.69)

UDEN (+) 0.58, ALMPGDP (+) 0.48, XL (+) 0.76, IMMILAWS (+) 0.48, TELEREVP (-) 0.41

This cluster can be interpreted as a country's *Openness to Immigration*, supported by a high amount spent on active labour market policies and high union densities. Hence, it relates to the bottom end of the labour market. The Scandinavian countries and Ireland rank high, whereas Switzerland, the US, Japan, Spain and Austria rank low.

C11: *Competition Policies* (Explained 66%, Second Eigenvalue 0.89)

BENEFIT (+) 0.88, TRADEPOL (+) 0.52, STATEINT (+) 0.46, STATECON (+) 0.50, PRICECON (+) 0.45, LOBBYING (+) 0.54, ANTITRUS (+) 0.83

Nearly all indicators in this cluster relate to *Competition Policies* (and competition practices). New Zealand, Germany, the UK, Sweden and Denmark rank at the top of this cluster, whereas the Latin European countries, Japan and France rank at the bottom.

C12: *Labour Quality* (Explained 77%, Second Eigenvalue 0.67)

INDUSREL (+) 0.45, COMLITER (+) 0.37, TOTQUALT (+) 0.37, NEWSPAPR (+) 0.51, LITERACY (+) 0.45, WORKERMO (+) 0.19, VALUESSO (+) 0.76

Apart from VALUESSO ("Values of the society support competitiveness") this is a very homogeneous cluster, which we interpret as *Labour Quality*. Not only does it contain indicators concerning the quality of the workforce, but also their impact on industrial relations. Note that this is not a classic human capital variable, since it contains no 'hard' schooling data. *Labour Quality* is high in Japan, the Scandinavian countries (Norway excluded) and Switzerland, and low in the Latin European countries, France and the UK.

C13: *Tax Incentives*[*] (Explained 66%, Second Eigenvalue 0.74)

NP12 (+) 0.41, TOPTAXES (-) 0.30, TAXPERSO (+) 0.62, AIRLINES (-) 0.51

We name this cluster *Tax Incentives*, because TOPTAXES (The top percentage marginal tax rate on personal income) is negatively associated with TAXPERSO ("Personal taxes encourage individual work initiative"). *Tax Incentives* are high in the Anglo-Saxon countries, in Portugal and Switzerland, and low in Sweden, Ireland, Denmark, Belgium and Italy.

C14: *Technology & Skills* (Explained 72%, Second Eigenvalue 0.70)

TECHNOCO (+) 0.57, SKILLEDL (+) 0.49, MANAGERS (+) 0.47, ENGINEER (+) 0.55

This very homogeneous cluster represents the *Technology & Skills* of a particular country, including managerial competence. Cluster 14 ranks from Japan, Germany and the Scandinavian countries (Denmark excluded) at the top to the Latin European countries, the UK and New Zealand at the bottom.

C15: *Labour Taxes* (Explained 72%, Second Eigenvalue 0.67)

PGROW (-) 0.63, TL (+) 0.30, T (+) 0.18

In contrast to *Tax Incentives* represented by cluster 13, which lays emphasis on the marginal tax rate on personal income, this cluster gives an indication of the level of *Labour Taxes* in a country. The negative correlation of T and TL with PGROW (The growth rate of population of working age) shows that this cluster also includes information about the tax burden in a country. Labour Taxes are high in Sweden, Italy, France, Finland and Spain, and low in Australia, Canada, Ireland, New Zealand and Japan.

C16: *Openness to Investment* (Explained 66%, Second Eigenvalue 0.74)

FORINVES (+) 0.28, VENTURES (+) 0.38, CORTAXES (-) 0.61

This cluster, which represents *Openness to Investment*, speaks for itself. It comes as no surprise that FORINVES ("Foreign investors are free to acquire control in a domestic company") and VENTURES ("Cross border ventures can be negotiated freely") are negatively correlated with CORTAXES (Corporate taxes as a percentage of GDP). *Openness to Investment* is high in Austria, Denmark, Germany, Ireland and Finland, and low in Japan, Australia, France, Norway and Canada.

C17: *Union Orientation* (Explained 82%, Second Eigenvalue 0.41)

UNCORD (-) 0.17, TEAPRI (+) 0.41, CENTRAL (+) 0.28

This cluster has the highest Proportion Explained. We name this cluster *Union Orientation*, because it combines union co-ordination in wage bargaining with the level at which bargaining occurs: plant, firm, industry or economy. *Union Orientation* is high in Switzerland, Ireland, the US, Canada and the UK and low in the Scandinavian countries (Finland excluded), Austria and Belgium.

C18: *Active Labour Market Policies* (Explained 78%, Second Eigenvalue 0.43)

ALMPPE (+) 0.25, ALMPPU (+) 0.32

This small cluster spreak for itself. *Active Labour Market Policies* are strong in the Scandinavian countries (Finland excluded), Portugal and Italy, and weak in Japan, Spain, Austria, the UK and Canada.

C19: *Post-Modern Characteristic* (Explained 74%, Second eigenvalue 0.52)

ERETIRE (+) 0.32, ENVIRONT (-) 0.31

This is an interesting result, although we cannot give this cluster a useful name. The early retirement index is negatively correlated with ENVIRONT ("Existing laws to protect the environment are compatible with the conduct of business"). The cluster tells us that countries with high non-participation rates for males aged 55-64, like Italy, Austria, the Netherlands, Belgium and Germany, generally have more stringent laws to protect the environment. Norway, Japan, Sweden, Switzerland and Ireland rank low in this cluster.

3.3 **Robustness**

In this subsection we focus our attention on the robustness of the results of our clustering procedure. We make a distinction between two types of robustness: the number of clusters and their composition should not be affected a great deal by a change in either (1) the stopping criterion we use in our clustering procedure (procedural robustness) or (2) the addition or deletion of a small number of indicators (input robustness).

Let us first look into procedural robustness. There are a number of parameters that influence the OPCCA procedure. The most important of these parameters is the stopping criterion. In our analysis, we stop the splitting of clusters when the second eigenvalue of each cluster that contains two indicators or more is less than one (which we will call our *basic procedure*). The effect of a lowering of this boundary to for example 0.95 is not as obvious as it seems. Not only will clusters 4 and 7 (which have a second eigenvalue between 0.95 and 1.00) be split, but during the third stage of the iteration indicators belonging to other clusters may be reassigned as well.

Performing OPCCA with this stopping criterion of a maximum second eigenvalue of 0.95 yields roughly the same clusters as our basic procedure. Cluster 4 splits into PROTECTI, SCHDAY, LONGOBJ, NATCULTR and OVER45 on the one hand and TOTALRES, ECOFLEXI and MARKETIN on the other hand. Cluster 7 splits into ENTREPRE, MARKETTI and ENTINNOV versus PARALLEL and RESTRUCT. In addition, INTERDIS goes from cluster 1 to 9, STRATALL from 1 to 5, PLIABILI from 2 to 8 and LIFEQUAL from 9 to 8. All other clusters remain the same.

Stopping the splitting procedure earlier, at a maximum second eigenvalue of 1.05, yields 17 clusters in total. Clusters 8 (*Government Priorities*) and 18 (*Active Labour Market Policies*) in our basic procedure come from a single cluster with a second eigenvalue of 1.02 and clusters 16 and 19 come from a cluster with a second eigenvalue of 1.002. The other clusters remain the same, so in the last two iterations in our basic procedure, no indicator has been reassigned during the third stage of these iterations.

Although there is no 'hard' statistical reason why we should choose 1.00 as a boundary between large and small second eigenvalues, this choice is customary in all sorts of analyses based on principal components. We have shown that slight variations in this boundary do not have a large impact on the final cluster structure. It is important to note that in the two alternatives stated above, there are some slight changes in the interpretation of the affected clusters, but these are minor.

Basing the end of the iteration on the proportion of variation explained instead of the second eigenvalue also yields similar results. In our basic procedure the least variation is explained by cluster 5, which accounts for 49%. Imposing 60% of variation explained results in 20 clusters, which are quite different from the clusters we have got in our basic procedure. The reason for this is the presence of one very large cluster containing 21 indicators 'pulling away' some key indicators from other clusters. This cluster has a second eigenvalue of 1.38 and does therefore not survive in our basic procedure. Setting a higher barrier of 67% will split this large cluster and yields 30 clusters in total, most of them containing three indicators or less. Most of the clusters in our basic procedure reappear in this result, although some of them have been fractured.

From experience we know that OPCCA is robust with respect to its inputs. We have constructed our data set of 101 indicators in a number of steps and after each step we have performed our cluster analysis. Most notably, the clusters representing *Social Infrastructure, Physical Infrastructure, Business Practices, Labour Market Flexibility* and *Labour Taxes* have remained roughly unaffected throughout our research.

The cluster variables created using the OPCCA method are typically not uncorrelated. In fact, some of the correlations between various clusters are quite high. Most of these correlations have the expected sign. *Social Infrastructure* (C1) for example has a strong positive correlation with *Business Practices* (C3), *Labour Market Flexibility* (C6), *Physical Infrastructure* (C9), *Competition Policies* (C11), *Labour Quality* (C12) and *Technology and Skills* (C14), whilst the latter is positively correlated with C3, C9 and C12. Another example is *Labour Market Flexibility* (C6), which is positively correlated with *Tax Incentives* (C13) and negatively with *Labour Taxes* (C15).

4 **Classification of the countries**

Overall, the results of our cluster analysis reveal that we can distinguish between 4 groups of countries:

1. The Scandinavian countries (Denmark, Finland, Norway and Sweden)
2. The Latin European countries (Italy, Portugal and Spain)
3. The Continental European countries (Austria, Belgium, France, Germany, The Netherlands and Switzerland)
4. The Anglo-Saxon countries (Australia, Canada, Ireland, UK, USA and New Zealand).

It is hard to find a place for Japan in these groups. In addition, in some clusters, France, Belgium, Ireland, New Zealand and Switzerland are outliers in this grouping. To illustrate this, we have plotted *Labour Quality* (C12) versus *Labour Market Flexibility* (C6). Figure 1 clearly reveals the grouping and the exceptions to the rule.

Figure 1 Labour Quality versus Labour Market Flexibility

The cross-country variation in labour market flexibility is larger than in labour quality. The Anglo-Saxon countries combine flexible labour markets with an average degree of labour quality, whereas the Latin European countries have inflexible labour markets and low labour quality.

Our classicifaction of countries is in accordance with existing classifications based on other data sets, such as the cultural dimensions of Hofstede (1980) and social capital of Knack and Keefer (1997).

Hofstede distinguishes 4 cultural dimensions. *Power Distance*, which defines the extent to which the less powerful persons in a society accept inequality in power and consider it as normal. *Individualism*, which opposes Collectivism (in an anthropological sense). Individualist cultures assume that any person looks primarily after his/her own interest and the interest of his/her immediate family. *Masculinity*, which opposes Femininity. Masculine cultures strive for maximum distinction between what men are expected to do and what women are expected to do. *Uncertainty Avoidance*, which defines the extent to which people within a culture are made nervous by uncertain situations.

Knack and Keefer distinguish *Trust*, which is the percentage of respondents in each nation replying "most people can be trusted". *Civic*, which measures the strength of norms of civic cooperation. *Putnam groups*, which approximates the density of horizontal networks in a society (religious organizations, education, arts, music, or cultural activities, youth work), and *Olson groups* with redistributive goals (trade unions, political parties, professional associations).

Table 1 Business Practices, Trust and Uncertainty Avoindance

To illustrate the simularities between our clusters and the data of Hofstede and Knack and Keefer,

Table 1 compares our *Business Practices* with *Trust* and *Uncertainty Avoidance*. In general, high Trust societies like the Scandinavian countries are characterized by high Business Practices and low Uncertainty Avoidance. The opposite holds for the Latin European countries (including Belgium and France). It is clear that the Anglo-Saxon countries, supplemented by Switzerland and the Netherlands, hold a middle position.

5 **Economic Success**

5.1 **Productivity and Unemployment**

In this section we relate our clusters to the economic performance of nations measured by two variables: GDP per hour worked and structural unemployment.

Table 2 GDP per Hour Worked and GDP per Capita both as a % of USA

GDP per hour worked comes from Van Ark and McGuckin (1999). Table 2 presents these figures as a percentage of US. Van Ark and McGuckin make a distinction between GDP per hour worked, GDP per person employed and GDP per head of population[2]. GDP per hour worked is calculated on the basis of actual hours worked per year. To give an example: in 1997 Belgium has the highest productivity both in terms of hours worked (107) and in terms of persons employed (104). However, labour force participation is relatively low in Belgium, so that GDP per capita amounts to only 79% of the US level. The differences between the two measures of labour productivity are substantial. In nearly all countries, GDP per hour worked is much higher than GDP per capita. The exceptions are Denmark and Switzerland, where labour force participation is relatively high and Japan and New Zealand, where the effect of working hours is positive. Obviously, the best measure for productivity is GDP per hour worked.

In terms of GDP per capita the US still is the leading country. In terms of GDP per hour worked, however, 4 countries (Belgium, France, the Netherlands and Norway) have exceeded the US productivity level in 1997. Between 1990 and 1997 most countries increased their productivity levels relative to the US. The fastest growing country is Ireland. The exceptions are Austria and Switzerland, which are lagging behind US productivity growth. It is striking that the Japanese productivity level is relatively low compared with most European countries (including Ireland and Spain). The lowest productivity levels are found in Portugal and New Zealand.

Table 3 Structural Unemployment as a % of Total Labour Force.

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[2] GDP has been converted to US$ at 1993 EKS PPPs.

The second measure of economic success is structural unemployment. The data in Table 3 come from Elmeskov, Martin and Scarpetta (1998), which are based on estimates of the non-accelerating wage rate of unemployment (NAWRU) for the OECD *Economic Outlook* (1998)[3]. The figures show that, in the 1990s, the structural unemployment rate has increased in Finland, Sweden, Germany, Switzerland, Italy, France, Belgium and Austria, remained fairly stable in Japan, Norway, Spain, Portugal, the US and Canada, and decreased in Denmark, Australia, New Zealand, the UK, the Netherlands and Ireland. The latter countries are the most successful.

We analyse the relation between institutions and economic success by using OLS. All regressions are run on 40 observations (the observations in 1990 and 1997 for each of the 20 countries). The independent variables are the 19 clusters developed above, a constant term and a dummy variable for the observations in 1997. We apply the Maximum R-square Improvement for Dependent Variable Method to detect the association between clusters and endogenous variables. The main finding is that the number of statistically significant clusters in a regression equation is restricted. The Tables 4 and 5 report the first 4 equations generated by the stepping procedure.

Table 4 Regressions to Explain Log GDP per Hour Worked

Table 5 Regressions to Explain Log Structural Unemployment

It appears that all coefficients are highly significant. The signs of the coefficients are robust with respect to the stepping procedure. Both productivity and unemployment can be explained to a high extent by a limited number of clusters. Starting from the 4-cluster model the increase in the explained variance in the next steps is rather small relative to the number of additional clusters, especially in the case of structural unemployment[4]. The 4-cluster model, therefore, gives a good impression of the relation between institutions and economic success. The dummy for 1997 only appears in the regressions for productivity and not in the regressions for unemployment. This is explained by the tendencies described above: between 1990 and 1997, GDP per hour worked has increased in almost all countries, whereas structural unemployment shows a more varied pattern. The implication is that part of the time-variation in productivity is not explained by our regressions, whereas the time-variation in structural unemployment is adequately captured by changes in (labour market) institutions[5].

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3 The correlation with the actual unemployment rates is strong.

4 We find that unemployment is negatively associated with *Labour Market Flexibility*. This is in line with the findings of Di Tella and MacCulloch (1998), who relate a time-series version of (only) one WCY indicator (labour-cost flexibility) to unemployment. We also find that the correlation between unemployment and *Union Orientation* is hump-shaped, with the Scandinavian countries on the left-hand side and the Anglo-Saxon countries on the right-hand side. *Union Orientation* combines union co-ordination in wage bargaining with the level at which bargaining occurs: plan, firm, industry or economy.

5 In contrast to the WCY data, labour market indicators represent information on two periods (see Data Appendix).

5.2 **Discussion**

In the existing literature on growth empirics, most authors relate individual indicators to productivity (or the growth rate of productivity). In our regressions we use combinations of individual indicators (clusters), so that it is not easy to compare our findings with the results of other growth regressions. The exceptions are the (partial) study of Nickell and Layard (1997), which we took as a starting point in collecting our data, and the study of Hall and Jones (1999), which relates productivity to differences in social infrastructure across countries.

Our *Social Infrastructure* is an important institution to explain differences in productivity across countries. This is in accordance with the main finding of Hall and Jones, who combine two indexes to measure *Social Infrastructure*. The first is an index of government antidiversion policies (GADP). Hall and Jones follow Knack and Keefer in using the average of five indicators from the International Country Risk Guide. The GADP variable is an equal-weighted average of these five indicators, each of which has higher values for governments with more effective policies for supporting production. The second index captures the extent to which a country is open to international trade according to several objective criteria.

Social Infrastructure contains 4 of the 5 indicators used by Hall and Jones. In addition, this cluster contains the answers to the WCY questions "Access to international distribution is well organized" and "Strategic alliances are common between domestic and foreign firms". Our measure of *Social Infrastructure* is therefore strongly related to the measure of Hall and Jones, although we do not use openness to international trade according to objective criteria. *Social Infrastructure* also contains the opinion of executives on: "Cost of capital does not hinder competitive business development", and "Intellectual property is adequately protected in your country".

Figure 2 Productivity versus Technology and Skills

There are only 2 clusters which show up in both equations: *Technology and Skills* and *Labour Quality*. *Technology and Skills* contributes most to the variation in output per hour worked. This supports the hypotheses from endogenous growth theory that knowledge accumulation is more accurately modelled as the desired outcome of entrepreneurial effort than as an accidental by-product of other activities. *Technology and Skills* is a very homogeneous cluster. An important element of this cluster is the number of R&D engineers relative to the labour force. *Technology and Skills* also contains the respons to the WCY questions "Technological cooperation is common between companies", "Skilled labour is easy to get", and "Competent managers are readily available". Figure 2 illustrates the positive correlation between productivity and *Technology and Skills*. (To get a clear picture we did not plot Portugal, which lags far behind Italy and Spain.) *Technology and Skills* ranks from Japan, Germany and Sweden at the top to the Latin European countries at the bottom. Strikingly, the position of Great Britain is among the latter group of countries. Figure 2 clearly reveals the exceptional position of Japan, which has the highest level of *Technology and Skills* but is among the countries with the lowest

level of productivity.

Labour Quality is negatively associated with productivity. The contribution of this cluster to the Sum of Squares is relatively modest. Nevertheless, this cluster did already appear in the third step of the regression (see Table 4), so that it can be seen an inextricable part of the final result. The dominant indicator in this cluster is WCY executive's opinion on "Employees truly identify with company objectives", which is highly correlated with their opinion on "Total quality mangement is comprehensively applied". The other indicators concern "Industrial relations between managers and employees are productive", "Computer literacy is generally high among employees", "Economic literacy is generally high among the population", and "Values of society support competitiveness". *Labour Quality* also contains the number of daily newspaper circulation per 1000 inhabitants. We prefer to call this cluster 'Labour Quality' instead of 'Human Capital', because no schooling indicators are involved. Both unemployment and productivity are negatively associated with this cluster. A simple mechanism might explain this. In countries with high *Labour Quality* wage push factors will be low, so that demand for labour will be relatively high. This fosters the development of labour intensive sectors and techniques, which depresses output per hour.

Figure 3 Unemployment versus Labour Quality

Labour Quality contributes a great lot to the variation in structural unemployment. As shown in Figure 3, there is a negative correlation between unemployment and this cluster. There are some remarkable outliers, however. Spain and Portugal at the left hand side of the picture have the same *Labour Quality*, but they perform very differently in terms of unemployment rates. (The same holds for Finland and Switzerland at the right side of the diagram.)

To explain unemployment, *Active Labour Market Policies* are very important. This result is also found in other studies on OECD labour markets. Our dataset contains 3 indicators on labour market policies. Interestingly, one of them, ALMPGDP (Spending on active labour market policies as % of GDP), is part of *Openness to Immigration*, which is positively associated with unemployment. Overall, apart from "union density" in *Openness to Immigration* and *Active Labour Market Policies*, there is no role for labour market indicators in explaining unemployment.

6 **Conclusion**

This paper suggests a method for measuring institutions. We use Oblique Principal Component Cluster Analysis to discover relationships between elements of institutions (individual indicators), resulting in new (latent) variables which we try to interpret as "real" institutions. The method is applied to a dataset consisting of more than 100 institutional indicators for 20 OECD countries, which are potentially important to explain differences across these countries. We reduce this information to a restricted number of clusters.

After clustering, simple OLS regression is used to relate the clusters to GDP per hour worked and structural unemployment. It appears that a restricted number of institutions can explain the cross-country variance and the time-variance in productivity and unemployment to a high extent. No more than 4 clusters explain 73% of the variance in productivity, whereas 4 clusters suffice to explain 87% of the variance in unemployment.

There is a sound theoretical reason for believing that any factor which reduces (the growth rate of) productivity tends to raise equilibrium unemployment (*cf.* Nickell and Layard, 1997). Our results reveal that there are two institutions which simultaneously raise productivity and unemployment: *Technology and Skills* and *Labour Quality*. Productivity and unemployment are positively associated with *Technology and Skills* and negatively with *Labour Quality*, which indeed points at a trade-off between our two measures of economic success. The simple explanation we have for this is that in countries with a high degree of *Labour Quality* wage push factors will be moderate, so that demand for labour will be relatively high. This fosters the development of labour intensive sectors and techniques, which depresses productivity. It is possible, however, to mitigate this trade-off by a favourable set of institutions. The examples are Norway, the Netherlands and the USA, where the level of productivity is among the highest and the rate of unemployment is among the lowest.

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Table 1 Business Practices, Trust and Uncertainty Avoidance

	Business Practices	Trust		Uncertainty Avoidance	
NZL	129			49	Low
SWE	118	57	High	29	Low
DNK	114	56	High	23	Low
FIN	95	57	High	59	Low
NOR	69	61	High	50	Low
CAN	62	50	Middle	48	Low
AUS	60	48	Middle	51	Low
USA	58	45	Middle	46	Low
IRL	38	40	Middle	35	Low
CHE	33	43	Middle	58	Low
NLD	31	46	Middle	53	Low
GBR	13	44	Middle	35	Low
WGR	-15	30	Low	65	High
AUT	-35	32	Low	70	High
BEL	-57	30	Low	94	High
FRA	-61	25	Low	86	High
JPN	-93	41	Middle	92	High
ESP	-167	35	Low	86	High
PRT	-168	21	Low	104	High
ITA	-224	26	Low	75	High

Table 2 GDP per Hour Worked and GDP per Capita as a % of US*

	GDP per Hour Worked		GDP per Capita
	1990	1997	1997
1 Austria	87	85	78
2 Belgium	100	107	79
3 Denmark	71	77	81
4 Finland	71	78	69
5 France	99	103	75
6 Germany (W)	91	99	75
7 Ireland	77	91	74
8 Italy	83	89	71
9 Netherlands	98	101	75
10 Norway	92	106	95
11 Portugal	44	47	47
12 Spain	66	70	55
13 Sweden	74	78	69
14 Switzerland	90	79	87
15 UK	78	84	72
16 Canada	81	81	78
17 US	100	100	100
18 Japan	65	68	83
19 Australia	73	81	76
20 New Zealand	58	58	62

* Source: Van Ark and McGuckin, 1999

Table 3 Structural Unemployment as a % of Total Labour Force*

	1990	1997
1 Austria	4.9	5.4
2 Belgium	11.0	11.6
3 Denmark	9.2	8.6
4 Finland	7.0	12.8
5 France	9.3	10.2
6 Germany (W)	6.9	9.6
7 Ireland	14.6	11.0
8 Italy	9.7	10.6
9 Netherlands	7.0	5.5
10 Norway	4.2	4.5
11 Portugal	5.9	5.8
12 Spain	19.8	19.9
13 Sweden	3.2	6.7
14 Switzerland	1.3	3.0
15 UK	8.5	7.2
16 Canada	9.0	8.5
17 US	5.8	5.6
18 Japan	2.5	2.8
19 Australia	8.3	7.5
20 New Zealand	7.3	6.0

* Source: Elmeskow, Martin and Scarpetta, 1998

Table 4 Regressions to Explain Log GDP per Hour Worked*

	N=1	N=2	N=3	N=4	N=4A
SOCIAL INFRASTRUCTURE				0.10	0.09
				(3.09)	(3.13)
LABOUR QUALITY			-0.09	-0.15	-0.15
			(2.46)	(3.94)	(4.22)
TECHNOLOGY & SKILLS	0.12	0.15	0.21	0.19	0.19
	(4.33)	(5.74)	(5.91)	(5.76)	(6.29)
POST-MODERN CHARACTERIS-		0.09	0.08	0.07	0.07
TIC		(3.72)	(3.26)	(3.23)	(3.24)
DUMMY 1997					0.10
					(2.66)
Number of Observations	40	40	40	40	40
R^2	0.33	0.51	0.58	0.67	0.73

*Ordinary Least Squares, t-values between parentheses. N is number of clusters. The constant term is 3.25 (N=1,2,3,4) and 3.20 (N=4A). (Mean productivity is 26)

Table 5 Regressions to Explain Log Structural Unemployment*

	N=1	N=2	N=3	N=4
LONG-TERM EMPHASIS	-0.34			
	(4.84)			
OPENNESS TO IMMIGRATION		0.26	0.39	0.35
		(4.29)	(9.03)	(9.73)
LABOUR QUALITY		-0.33	-0.29	-0.46
		(5.29)	(7.42)	(8.91)
TECHNOLOGY & SKILLS				0.22
				(4.16)
ACTIVE LABOUR MARKET POLICIES			-0.32	-0.29
			(7.35)	(7.82)
Number of Observations	40	40	40	40
R^2	0.38	0.53	0.81	0.87

*Ordinary Least Squares, t-values between parentheses. N is number of clusters. The constant term is 1.94 (in all regressions). (Mean unemployment rate is 7%).

Data Appendix

Our data set consists of 40 observations, two observations for each of the following 20 industrialized countries: Austria (AUT), Belgium (BEL), Denmark (DNK), Finland (FIN), France (FRA), West Germany (WGR), Ireland (IRL), Italy (ITA), The Netherlands (NLD), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), Canada (CAN), The United States (USA), Japan (JPN), Australia (AUS) and New Zealand (NZL).

Economic succes is measured by two variables: GDP per hour worked (from Van Ark and McGuckin, 1999) and structural unemployment (from Elmeskov, Martin and Scarpetta, 1998). The two observations for each country represent two years: 1990 and 1997:

LNSTRUC	Log structural unemployment rate (1990, 1997)
LNPROD	Log GDP per hour worked (1990, 1997).

The bulk of the indicators come from the *World Competitiveness Yearbook* (IMD 1985, 1991, 1994 and 1996)[6]:

ACCESSIN	Access to international markets is well organized in your industry (1996)
AIRINFRA	Air transport infrastructure meets business requirements very well (1994)
ANTITRUS	Anti-trust laws do prevent unfair competition in your country (1994)
ARABLEAR	Log arable area (m^2/capita, 1996)
BASICRES	Basic research supports long-term economic and technological development (1996)
BURCRACY	Bureaucracy does not hinder business development (1994)
CAPITALT	Capital and property taxes revenues 1994 as a percentage of GDP (1996)
COBOARDS	Corporate boards are safeguards for proper practices in corporations (1996)
COMLITER	Computer literacy is generally high among employees (1994)
COMPPRIC	Competitive pricing. Domestic products rated by executives (1991)
COMPUTER	Log computer power per capita (1994)
CORTAXES	Corporate taxes on profits, income and capital gains as a percentage of GDP (1985, 1991)
COSTOCAP	Cost of capital in your country does not hinder competitive business development (1994)
DELEGATE	Willingness to delegate authority to subordinates is generally high (1994)
EXOFLEXI	Effectiveness of the economy in shifting resources from new industries (1991)
EDSYSTEM	The educational system meets the needs of a competitive economy (1996)
ENTINNOV	Managers generally have a good sense of entrepreneurship and innovation (1996)
ENTREPRE	Managers generally have a good sense of entrepreneurship and innovation (1994)

[6] Logs are taken by the authors.

ENVIRONT	Existing laws to protect environment are compatible with the conduct of business (1996)
FORINVES	Foreign investors are free to acquire control in a domestic company (1996)
FORLANGS	Foreign languages are taught extensively at compulsary schools (1994)
FREEMANA	Managerial freedom. Extent to which management is free to allocate corporate assets as preferred (1991)
GOVECPRT	Government economic priorities. Extent to which government policies favor investment and growth rather than distribution of wealth (1991)
HIRINGFI	Hiring and firing practices are flexible enough (1994)
IMMILAWS	Immigration laws do not prevent your company from employing foreign skills (1996)
IMPROPER	Improper practices do not prevail in the public sphere (1994)
INDUSDIS	Log industrial disputes, working days lost per 1000 inhabitants per year (1985, 1994)
INDUSREL	Industrial relations between managers and employees are generally productive (1994)
INTELPRO	Intellectual property is adequately protected in your country (1994)
INTERDIS	Access to international distribution is well organized in your country (1994)
LIFEQUAL	Quality of life in your country is very adequate (1996)
LITERACY	Economic literacy is generally high among the population (1996)
LOBBYING	Lobbying by special interest groups does not distort government decision making (1994)
LONGOBJE	Long-term objectives. Emphasis on the long term in strategic decision making (1991)
MANAGERS	Competent senior managers are readily available on the market (1996)
MARKETDO	Market dominance by a few enterprises is rare in key industries (1994)
MARKETIN	Marketing orientation. Extent to which domestic companies are marketing oriented compared to their international competitors (1991)
MARKETTI	Launching a new product into the market generally takes less time than in foreign competitors (1996)
NATCULTR	National culture is open towards foreign cultures (1996)
NEWINFOT	New information technology meets business requirements very well (1996)
NEWSPAPR	Daily newspaper circulation per 1000 inhabitants (1996)
NONWAGES	Non-wage incentives such as profit sharing and stock purchase plans are used effectively to motivate employees (1994)
PARALLEL	Parellel economy enhances business development in your country (1996)
PLIABILI	Product liability as practiced in your country is appropriate for the purposes of customer protection (1996)
PORTACCE	Port access infrastructure meets business requirements very well (1994)
POSTINGS	Overseas postings are readily accepted among managers in your country (1996)
PRICECON	Price controls of the government do not affect pricing of products in most industries (1994)
PROTECTI	National protectionism does not prevent foreign products and services from being

	imported (1994)
ROADINFR	Roads infrastructure meets business requirements very well (1994)
RAILINFR	Railroads infrastructure meets business requirements very well (1994)
RESTRUCT	The domestic economy is well-adapted for long-term competitiveness (1996)
SKILLEDL	Skilled labour is easy to get in your country (1996)
SOCIALRE	Managers pay a lot of attention to their responsibility towards society (1996)
STATECON	State control of enterprises does not distort fair competition in your country (1994)
STATEINT	State interference in your country does not hinder the development of business (1994)
STRATALL	Strategic alliances are common between domestic and foreign firms (1994)
TAXPERSO	Personal taxes encourage individual work initiative (1996)
TECHNOCO	Technological cooperation is common between companies (1996)
TELECOMM	Telecommunications infrastructure meets business requirements very well (1994)
TOPTAXES	Top percentage marginal tax rate on personal income, effective for most of 1990 (1991)
TOTALRES	Total expenditure on R&D as a percentage of GDP (1985, 1994)
TOTQUALT	Total quality management is comprehensively applied in your country (1996)
TRADEPOL	Trade policies in your country support international activities of your country in the long term (1994)
VALUESSO	Values of the society support competitiveness (1996)
VENTURES	Cross border ventures can be negotiated freely (1996)
WORKERMO	Employees truly identify with company objectives (1996)

Labour market indicators come from Nickell and Layard (1997). Each indicator represents information on the periods 1983-88 and 1989-94 respectively.

Direct indicators of labour market rigidity are:

EMPRO	Employment protection (0 = no regulation, 20 = strict regulation
LSTAND	Labour standards (0 = lax or no legislation, 10 = strict legislation)

The official treatment of the unemployed is summarized by:

BENEFIT	Benefit duarion (years, 4 = indefinite)
RRATE	Benefit replacement ratio (% of income replaced by unemployment benefits)

The process of wage bargaining is characterized by:

CENTRAL	Centralization of wage bargaining (1 = most centralized)
EMCORD	Employer coordination in wage bargaining (1 = low, 2 = middle, 3 = high)

UDEN	Union density (%)
UNCORD	Union coordination in wage bargaining (1 = low, 2 = middle , 3 - high)
UNION	Union coverage index (1 = <25% of workers covered by collective agreements, 2 = 25-70%, 3 = >70%)

In addition Nickell and Layard introduce:

ERETIRE	Early retirement index (non-participation rate for males aged 55-64)
HOME	Percentage of households who are owner-occupiers
HOURS	Hours worked per year; work sharing
INFLA	Change in inflation rate (% points)
NP12	Proportion employed tenure < 2 years
PGROW	Growth rate of population of working age (%)
T	Payroll tax rate (%)
TL	Total tax wedge (%)[7]
XL	Real interest rate (%)

Data on active labour market policies are from Martin (1998):

ALMPGDP	Spending on active labour market policies as % of GDP (1990, 1996)
ALMPPE	Share of expenditures on active measures in total public expenditure on labour market measures (1985[8], 1996)
ALMPPU	Spending on active labour market policies per person unemployed as percentage of GDP per member of the labour force (1990, 1996)

From the *OECD Jobs Study* (1994) we have:

ENGINEER	Total R&D scientists and engineers of university graduates per 100 of labour force (1991)
OVER45	Share of the labour force aged 45 and over (1990)

Some productivity measures in service industries from Pilat (1996):

AIRLINES	Airlines operating expense per available tonne kilometre (1993)
DISTRITE	Distribution GDP per person engaged (1990)

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[7] New Zealand estimated by imposing the same TL/T ratio (per period) as in Australia.

[8] Italy: 1996.

MAINLINS Telecommications mainlines per 100 inhibitants (1992)
TELEREVP Telecommunications revenue per employee (1992)

Educational indicators are taken from Lee and Barro (1997):

SCHDAY Number of school days at primary school[9]
SHPUPP Real government current educational expenditure per pupil at primary school as % of real GDP (1985, 1990)
SHPUPS Real government current educational expenditure per pupil at secundary school as % of real GDP (1985, 1990)
TEAPRI Pupil-teacher ratio at primary school (1985, 1990)

Some indicators concerning business risks are from the International Country Risk Guide (Knack and Keefer, 1995)[10]:

BURDELAY Bureaucratic delay (1= long, 4 = short, 1980, 1990)
COMTRANS Communication and transport quality (1 = low and 4 = high, 1980, 1990)
CONTENFO Contract enforceability (1 = low and 4 = high, 1980, 1990)
NATIRISK Nationalization risk (1 = high and 4 = low, 1980, 1990)

[9] Lee and Barro give one data point per country, without the year of observation.

[10] The data for Austria are from 1992 and 1995 and the data for Finland from 1995 (for both periods). The data for New Zealand are estimated by regressing each of the four variables separately on GADP, a composite constructed by Hall and Jones (1996) and a constant.

List of Clusters

C1: *Social Infrastructure* (INTERDIS+, INTERLPRO+, NATIRISK+, STRATALL+, BURDELAY+, COMTRANS+, COSTOCAP+, CONTENFO+, INFLA+)

C2: *Employer Orientation* (RRATE+, CAPITALT-, EMCORD+, PLIABILI+, FORLANGS+, EDSYSTEM+)

C3: *Business Practices* (BURCRACY+, IMPROPER+, TELECOMM+, DELEGATE+, COMPUTER+, POSTINGS+, NEWINFOT+, COBOARDS+)

C4: *Long-Term Emphasis* (PROTECTI-, TOTALRES+, SCHDAY+, ECOFLEXI+, LONGOBJE+, MARKETIN+, NATCULTR-, OVER45+)

C5: *Labour Immobility* (HOME+, MARKETDO-, SHPUPS-, INDUSDIS+, DISTRITE-, ARABLEAR+)

C6: *Labour Market Flexibility* (UNION-, LSTAND-, EMPRO-, HIRINGFI+, NONWAGES+, FREEMANA+)

C7: *Entrepreneurship* (ENTREPRE+, PARALLEL+, RESTRUCT+, MARKETTI+, ENTINNOV+)

C8: *Government Priorities* (HOURS+, COMPPRIC+, SHPUPP-, GOVECPRT+)

C9: *Physical Infrastructure* (ROADINFR+, AIRINFRA+, RAILINFRA+, PORTACCE+, ACCESSIN+, SOCIALRE+, BASICRES+, LIFEQUAL+, MAINLINS+)

C10: *Openness to Immigration* (UDEN+, ALMPGDP+, XL+, IMMILAWS+, TELEREVP-)

C11: *Competition Policies* (BENEFIT+, TRADEPOL+, STATEINT+, STATECON+, PRICECON+, LOBBYING+, ANTITRUS+)

C12: *Labour Quality* (INDUSREL+, COMLITER+, TOTQUALT+, NEWSPAPR+, LITERACY+, WORKERMO+, VALUESSO+)

C13: *Tax Incentives* (NP12+, TOPTAXES-, TAXPERSO+, AIRLINES-)

C14: *Technology and Skills* (TECHNOCO+, SKILLEDL+, MANAGERS+, ENGINEER+)

C15: *Labour Taxes* (PGROW-, TL+, T+)

C16: *Openness to Investment* (FORINVES+, VENTURES+, CORTAXES-)

C17: *Union Orientation* (UNCORD-, TEAPRI+, CENTRAL+)

C18: *Active Labour Market Policies* (ALMPPE+, ALMPPU+)

C19: *Post-Modern Characteristic* (ERETIRE+, ENVIRONT-)

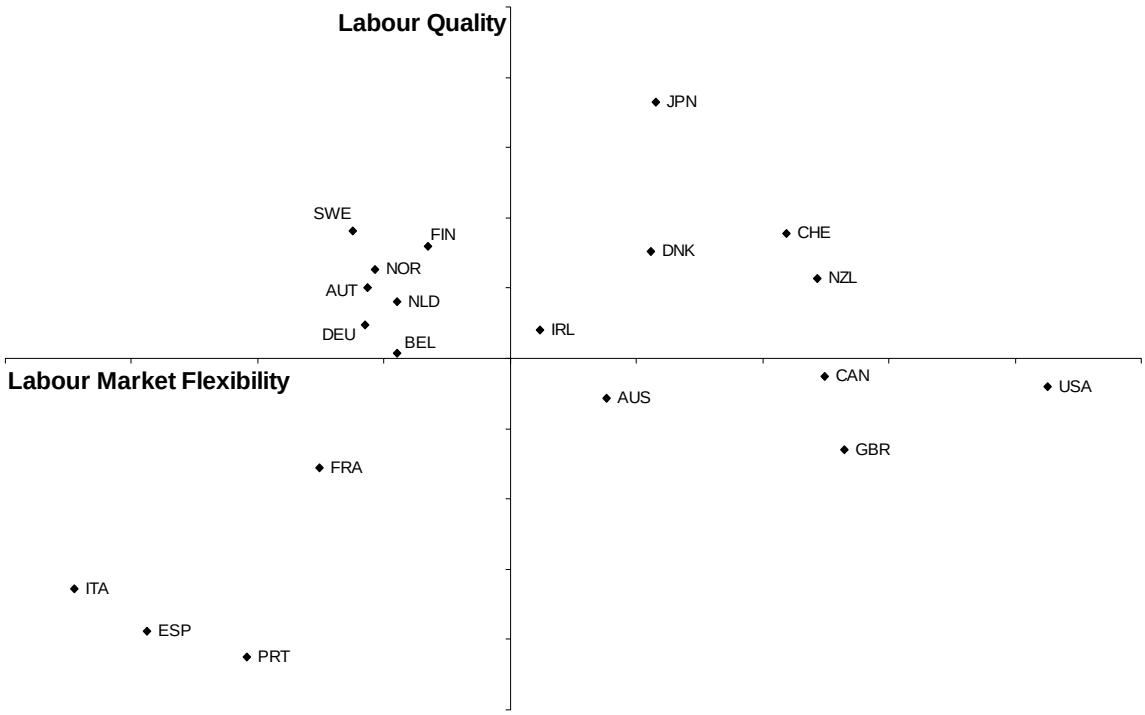

Figure 1 - Labour Quality vs. Labour Market Flexibility

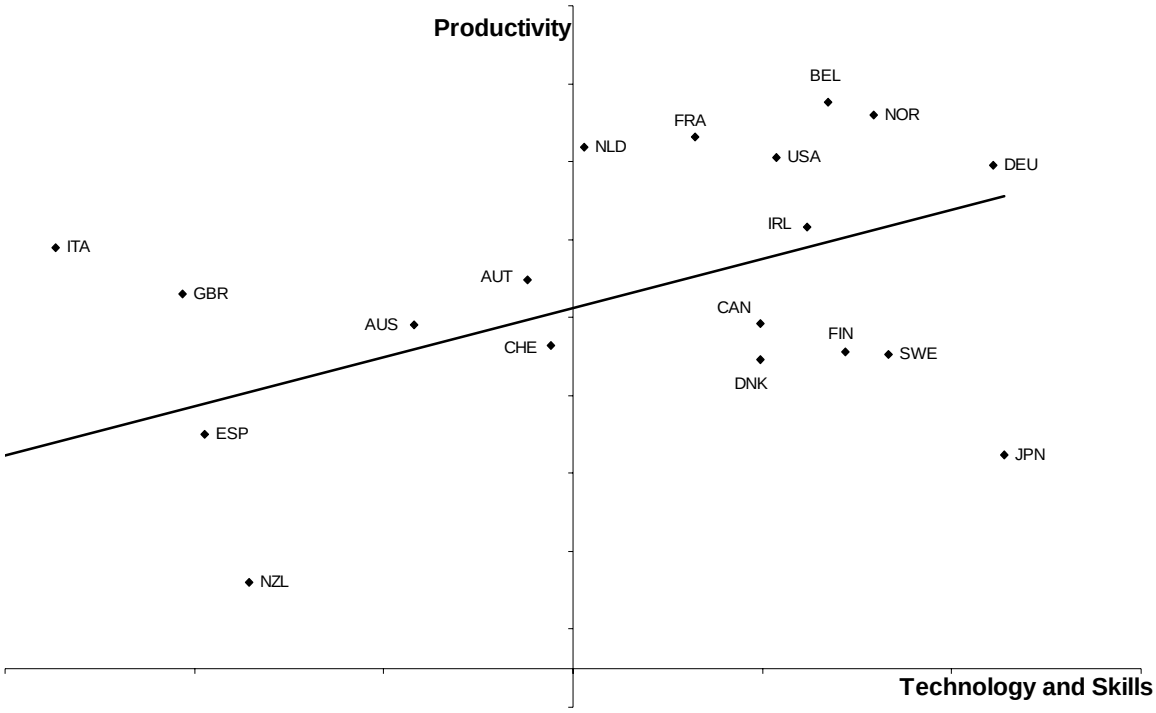

Figure 2 - Productivity vs. Technology and Skills

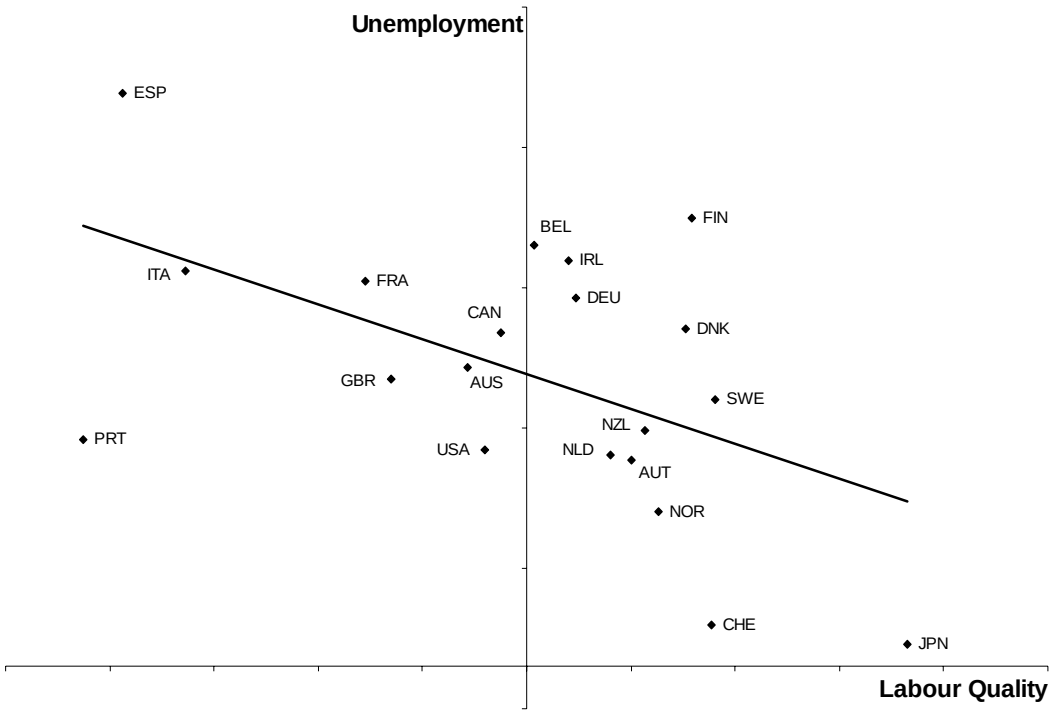

Figure 3 - Unemployment vs. Labour Quality